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U.S. PATENT APPLICATION

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Invention: COMMUNICATION IDENTIFIER METHOD

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SPECIFICATION

~~Communication Identifier Method~~

Field of the invention

The invention is related to RADIUS-accounting communication and in particular [an arrangement] a method for assigning unique identifiers for allowing communication between a GPRS (General Packet Radio Service)l-system and a RADIUS (Remote Authentication Dial In User Service) server.

~~The problem areas~~

RADIUS (Remote Authentication Dial In User Service) is a protocol used to authenticate remote users logging in to a network and is used as the way to authenticate users in a GPRS-system. In case the RADIUS-server provides the subscriber with a dynamic IP-address to use, a RADIUS accounting-server is uses to mark the address as used and freed.

The GPRS (General Packet Radio Service) offers a high-speed, packet-switched, mobile datacommunication network, where the subscribers can connect themselves to an external network from a mobile terminal. The GPRS system consists mainly of two nodes, where the Gateway GPRS Support Node (GGSN) is the component involved in this invention.

The subscribers need an IP (Internet Protocol)-address to route packets to and from the external network. This address can be provided by a RADIUS-server, in which case a unique identifier must be provided to relate the subscriber to this IP-address. The identifier is described as attribute Acct-Session-Id in IETF RFC 2139 (April 1997) "RADIUS Accounting". Due to the nature of a GPRS system, a subscriber will with a high degree of probability be connected to an external network for a long time, allocating the IP-address for an equally long period of time.

The RADIUS accounting server is requested to start an accounting session when the RADIUS client sends an accounting start request towards the RADIUS accounting server. This is done to mark the address as used by the subscriber in the RADIUS accounting server. The RADIUS client in the accounting start request must give an identifier, and the same identifier is sent in an accounting stop request to stop the accounting and release the IP-address. The identifier must be generated for each

subscriber" connection receiving an address from the RADIUS server, and it must be guaranteed to be unique for each connection.

The GPRS-system can be connected to several external networks, and all the networks may use the same RADIUS server. The different networks may also contain the same range of addresses (private address-space), and hence the RADIUS server must be able to give out the same IP-address to subscribers belonging to the different external networks.

~~**Known solutions and problems with these.**~~

The identifier is usually made from the time in the system acting as a client (usually an NAS) towards the RADIUS server. Other solutions are one or several counters that are incremented for each new accounting session and/or for each restart of the system. It is also known that some implementations use process identifiers as a part of the identifier.

The main problem with the above-mentioned solutions is that they all require system resources to create and maintain the generation of the identifiers. Getting the system-time does not require any storage, but may be inaccurate or inefficient in case of a large number of simultaneously requests for the system-time. Having counters to be incremented will use system memory, computational time to recalculate the values and some algorithm to avoid two subscribers getting the same value of the counter. The counter must also be large enough to generate enough identifiers to all the possible subscribers. These values will not be predictable and are usually based on statistical distribution to assure uniqueness; hence they can not be guaranteed to be absolutely unique.

~~**Objects of the invention**~~

An object of the invention is to overcome the problems related to prior art solutions in the art, by providing unique identifiers without involving necessity for any new system resources other than those already available.

~~**Brief disclosure of the invention**~~

The method according to the invention includes the steps of:

- connecting one or more external networks to the GPRS system and identifying the or each network with an APN (Access Point Name), and
- assigning to an or each APN external network a gateway address,

and the further steps of:

- passing an APN-external network authentication request from a GGSN (Gateway GPRS support Node) to said RADIUS server,
- providing from said RADIUS server to said GGSN upon such request a subscriber IP (Internet Protocol) address to be stored in said GGSN (Gateway GPRS Support Node), said subscriber IP address being unique for the respective APN external network defined in said GGSN,
- using said GGSN for combining the APN gateway address and the subscriber IP address, to form a unique subscriber identifier, and
- sending from said GGSN said identifier to the RADIUS server for accounting, e.g. in the form of an ASCII string.

Further characteristic features of the invention will appear from the following description and the attached patent claims, and with reference to the enclosed drawing figures.

Brief description of the drawings

Figure 1 illustrates the basic steps for generating an identifier, and

Figure 2 illustrates three external networks with a subscriber connected to each network.

~~**Detailed description of embodiments**~~

The invention is now to be described firstly with reference to Figure 1.

When connecting an external network to the GPRS system, the network is identified with an Access Point Name (APN), such as e.g. APN1 (see Figure 1). Each APN is given a gateway address GW in the GGSN, as seen from the external network. By assuring that this IP-address is unique for each APN defined in the GGSN, all the external networks will have its own, unique identifier. Since two subscribers (MS) in the same external network should never use the same IP-address at the same time, subscribers connected to the same APN will always have different IP-addresses. The

idea is to combine these two IP-addresses, the gateway-address for the APN and the address assigned to the subscriber, to form the identifier.

When the GGSN receives an IP-address to send to the subscriber from the RADIUS-server, it looks up the gateway-address belonging to the external net to which the subscriber is connecting himself. This address has already been configured when the external network is attached to the GPRS-system, and checked to be unique within the GGSN.

To construct the identifier to send to the RADIUS accounting-server the GGSN will now use these two available IP-addresses. The addresses can be appended to form a eight byte long identifier (in case of IP-addresses from IP version 4), or the numbers could be converted to ASCII numbers to make the string printable. When the numbers are converted it would be wise to insert dots (ASCII value 46) between the decimal-groups in the addresses to be able to clearly see the addresses used in the identifier (e.g. for an operator looking into the accounting records).

Gateway-address = 129.24.24.1

MS IP-address = 129.24.24.24

ASCII codes: 129 24 24 1 129 24 24 24 (non printable)

Or transform the number to ASCII codes for the numbers to make them printable:

ASCII codes: 49 50 57 46 50 52 46 50 52 46 49 46 49 50 57 46 50 52 46 50 52 46 50 52 (which would be readable as "129.24.24.1.129.24.24.24")

The identifier is suitably passed to the RADIUS server as an ASCII string. (See Figure 1).

Thus, the gateway address is the address of the GPRS-system/GGSN as seen from the external network (APN, e.g. APN1) and the subscriber could be a mobile terminal MS connected to the external network through the GPRS-system.

On Figure 2, the subscribers MS1, MS2 and MS3 have for sake of reference to their respective networks APN1, APN2 and APN3 been indicated on the right hand side of the drawing figure.

The APN name and the respective APN gateway address to the GGSN seen from the network are configured, as such new network is linked to the GPRS system. The operator will normally manually assign the APN name and the gateway address, and the RADIUS server is not involved in such operation.

Figure 2 shows three external networks connected to a GGSN node in a GPRS system. Each network has one subscriber connected and all the three networks use the same RADIUS server for authentication and dynamic IP-address allocation for the subscribers. Even though the networks identified as APN2 and APN3 has assigned the same IP-address to the two subscribers, the identifier will be unique because of the different gateway addresses. Table I shows the generated identifiers for the three subscribers.

Table 1

APN	Gateway Address	Subscriber IP Address	Identifier
APN1	129.24.24.1	129.24.24.24	"129.24.24.1.129.24.24.24"
APN2	193.25.01	193.25.5.1	"193.25.0.1.193.25.5.1"
APN3	193.26.0.1	193.25.5.1	"193.26.01.193.25.5.1"

Advantages

The creation of the identifier used for accounting purposes described above will not involve any new resources than the ones already available. Since the addresses already are unique, the combination of the two addresses will form a perfectly valid identifier. This will not restrict any limitations on concurrency regarding RADIUS accounting messages, and the identifier is guaranteed unique as long as the subscriber is still using the assigned IP-address (i.e. no accounting stop has been sent towards the RADIUS server). The creation of the identifier will not use any extra resources whatsoever, and will always be available as long as an IP-address exists.

The identifier will also be very predictable, and only by looking at this one can tell which external network the accounting record belongs to, as well as knowing the IP-address for the subscriber.

Whenever several IP-addresses are available, which together will identify the object in question uniquely, these addresses can be concatenated to form a unique identifier.